

Amendments to the Specification

Page 1, before line 1, the paragraph beginning with "The invention relates" insert the following title:

-- BACKGROUND OF THE INVENTION--

Page 1, before line 17, the paragraph beginning with "Therefore, it is" insert the following title:

--OBJECTS AND SUMMARY OF THE INVENTION--

Please replace the paragraph beginning on page 1, line 20 with the following rewritten paragraph:

B1
In accordance with the invention this object is achieved by means of a method as disclosed in claim 1 wherein the position of the medical instrument within the object to be examined is determined by means of a localization device that is arranged in the end zone of the medical instrument that is to be introduced, image information concerning the vicinity of the medical instrument being acquired at the same time by means of an image acquisition device arranged on the medical instrument, the position of the medical instrument being reproduced in a survey image of the object to be examined on the basis of the position determined, and images of the vicinity of the object to be examined which are associated each time with the relevant position being displayed on the basis of the image information acquired.

Please replace the paragraph beginning on page 2, line 1 with the following rewritten paragraph:

which includes

This object is also achieved by means of a device as claimed in claim 10

localization means for determining the position of the medical instrument in the object to be examined, a localization device being arranged in the end zone of the medical instrument that is to be introduced,

imaging means for the acquisition at the same time of image information concerning the vicinity of the medical instrument, an image acquisition device being arranged on the medical instrument, and

B2
data processing and display means for determining and displaying the position of the medical instrument in a survey image of the object to be examined, that is, on the basis of the position thus determined, and for determining and displaying images of the vicinity of the object to be examined, said images being associated with the relevant position, on the basis of the image information acquired.

Please replace the paragraph beginning on page 3, line 22 with the following rewritten paragraph:

B3
The claims 2 to 5 disclose various advantageous embodiments of the localization device used. This device may be a magnetic field sensor whose position is determined by means of an external measuring device, or an active or a passive microcoil whose position can be determined by means of a magnetic resonance device, or also an ultrasound sensor which can be detected by means of an ultrasound device. Moreover, the medical instrument may also consist at least partly of a material that can be detected by means of an ultrasound device or a magnetic resonance device. Also feasible is any other punctiform signal source that can be arranged on the medical instrument and whose signal can be detected by an external detector device so as to determine the position of the signal source therefrom.

Please replace the paragraph beginning on page 3, line 32 with the following rewritten paragraph:

B4
- Advantageous further possibilities for the use of an image acquisition device are given in the claims 6 to 9. It provided. That is, it is a common aspect of all image acquisition devices that they are preferably arranged in the end zone of the medical instrument that is to be introduced, because notably image information from this region is of interest. The transfer of the acquired image data may take place in a contactless manner or via leads. Many further embodiments of the image acquisition device additionally require external image acquisition means for the acquisition of image information. For example, one embodiment of the MR device which is preferably implemented as a microcoil requires an external excitation coil as it is used in a magnetic resonance tomography device. Other further embodiments, for example an internal excitation and measuring coil, an endoscope or an intravascular ultrasound device, however, do not require additional external image acquisition means.

Please replace the paragraph beginning on page 4, line 23 with the following rewritten paragraph:

B5
- The invention also relates to a corresponding device as disclosed in claim 10 for determining the position of a medical instrument in an object. The invention furthermore relates to a medical instrument to be introduced into an object to be examined, which instrument includes a localization device that is arranged in the end zone that is to be introduced and serves to determine the position of the medical instrument in the object to be examined, and also includes an image acquisition device for the simultaneous acquisition of

B5

image information concerning the vicinity of the medical instrument, the position determined being intended for use in determining and reproducing the position of the medical instrument in a survey image of the object to be examined and the acquired image information is intended to form and reproduce images of the vicinity of the object to be examined which is associated with the relevant instantaneous position as indicated in claim 11. The device as well as the medical instrument may be elaborated in accordance with the invention so as to form advantageous embodiments which are identical or analogous to the versions disclosed above for the method.

Please replace the paragraph beginning on page 5, line 7 with the following rewritten headings and paragraphs:

--BRIEF DESCRIPTION OF THE DRAWING

B6

The invention will be described in detail hereinafter with reference to the sole Figure which is a schematic diagram of a system according to the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

B6

Its The block diagram in the figure shows the essential elements of a device in accordance with the invention. A recumbent patient 1 is arranged on a patient table 2 in order to perform an intravascular intervention in this device. A catheter 3 in accordance with the invention is introduced into a main artery of the patient 1 for a treatment of the coronary arteries and is advanced as far as the coronary vessels by a physician. The end zone of the catheter which is introduced into the patient 1 is provided with an image acquisition device 4 and a localization device 5. It is assumed that the image acquisition device 4 of the embodiment shown is formed by a microcoil -4- which, after excitation by an external excitation coil 6, can receive magnetic

B6

resonance (MR) signals from its vicinity, said signals supplying image information concerning the vicinity of the microcoil image acquisition device 4. This procedure is known per se, like a magnetic field coil for generating a steady magnetic field (not shown), from the field of magnetic resonance tomography, so that it will not be elaborated herein.

Please replace the paragraph beginning on page 5, line 20 with the following rewritten paragraph:

B7

--Furthermore, in the end zone of the catheter 3 there is arranged a localization device 5 which is assumed to be constructed as a magnetic field sensor in the embodiment shown; such a sensor co-operates with a coil array 7 that is arranged underneath the patient 1. Using the signals emitted by the individual coils of the coil tableau array 7, the position of the magnetic field sensor, and hence the position of the end zone of the catheter 3, can be determined on the basis of the signals received from the magnetic field sensor 5. This method of determining a position is also known per se and will not be elaborated herein.

Please replace the paragraph beginning on page 6, line 6 with the following rewritten paragraph:

B8

--The data processing device 12 determines, on the basis of the data received, the position of the magnetic field sensor 5, and hence of the end zone of the catheter 3, in relation to a stored image data set of the examination zone of the patient 1. This image data, formed directly before the intervention or during an earlier diagnosis, is stored in a database 13 which is accessible by the data processing device 12. In order to enable determination of a current position of the magnetic sensor 5 relative to a survey image derived from the database 13,

moreover, suitable registration is required, for example by means of suitable markers on the patient which are also present in the survey images and are marked as reference points directly before the intervention. In the embodiment shown, relating to an intravascular intervention, a three-dimensional angiogram (a so-called road map) of the coronary vessels is preferably used as the survey image. Finally, the data processing device 12 applies the image information to a display device, for example a monitor 14 on which the survey image 15 in which the current position of the magnetic field sensor 5 or the tip of the catheter 3 is also superposed is displayed on one side. Moreover, the instantaneous image 16 of the vicinity of the catheter tip, formed from the data acquired by the microcoil 4, is displayed adjacently so as to supply the physician with additional information enabling him to determine where the catheter tip is situated at the relevant instant, thus enabling better navigation. No X-ray device is then required for the acquisition of image information, that is, notably no fluoroscopy device which would permanently expose the patient to X-rays during the acquisition of information.

Please add the following paragraph before the paragraph starting on page 6, line 26:

B9
A computer 20 having a computer program 20a on a computer readable medium may be connected to the data processing device 12, the position processing and control device 9, the image processing and control device 8, the database 13, and the monitor 14 for controlling the device and or the medical instrument of the present invention.